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MSTA
NEWSLETTER

Montana Science Teachers Association

Vol. 6, No. 5 "Dedicated to quality science education" DECEMBER 1987

Science Teachers Win Awards, Recognition

Three state science teachers were recognized recently for excellent performance. Larry Funk of Libby High School and Glen Govertson of Sentinel High School, Missoula, were each awarded $350 donated by the Montana Science Teachers Association, Montana Power, Montana Academy of Science, and the Office of Public Instruction.

Gil Alexander of Helena High was this year's Presidential honoree. He and his wife Marilyn went to Washington, D.C. in November for a week of workshops and receptions with other national winners recognized for excellence in science and mathematics teaching. One of the benefits is a $5,000 grant from NSF for his school.

Sue Dolezal of Sentinel High, Missoula, was one of 52 math teachers selected nationwide for a Presidential award. She will also go to Washington where she hopes to spend some time at the Smithsonian.

The Montana Junior Academy of Science

Introduction: The Junior Academy of Science program offers high school students the unique opportunity of presenting the results of their research using the same methods and in exactly the same setting as that provided practicing scientists. The Montana Academy of Science (MAS) has established a chapter of the Junior Academy and encourages high school students to submit papers for possible presentation at the yearly MAS proceedings. Students submitting outstanding papers will be invited to present them at the regular morning sectionals of MAS and to repeat their presentation at the afternoon sectional of the Junior Academy. The author of the top paper will be invited to present his/her paper at the annual proceedings of the National Junior Academy of Science the following winter. Both MAS and the Montana Science Teachers Association (MSTA) have agreed to assist in the funding of this program. All students who submit a paper for consideration will be given a certificate by MAS. An abstract of all papers presented will be published in the annual MAS Proceedings which is mailed to all Junior Academy members. Those not selected to present their papers at the proceedings will be invited to a poster display of their projects in the Junior Academy room at the annual meeting. All junior members are encouraged to attend the regular morning sectionals and hear papers presented by our Montana scientists.

The Call for Papers:

Participants: High school students who have completed a science research project.

Send papers to: The Sectional Vice-President of the appropriate subject matter area.

Deadline for Papers: January 15, 1988.

Participation for Members Only: Include a student membership fee of $5.00 with the form letter accompanying each student paper.

The Selection Process: The MAS vice-president will select one or more papers submitted by Junior Academy members and will schedule their presentation for a morning session of their sectional. All papers reviewed will be returned to the MAS Junior Academy sectional vice-president who will: 1) send all papers scheduled for presentation to a final committee of scientists who will select the top paper and two alternates; 2) notify the students who will present papers and request that they submit an abstract of their work for publication; 3) send certificates of publication to all non-presenting students and invite them to participate in a poster session at the proceedings.

The MAS Proceedings:

a. March 26, 1988, on the campus of Montana Tech.

b. Regular MAS sectionals (A.M. sessions)—Paper presentations by practicing scientists to include junior members designated by the above process. Everyone is encouraged to attend as many presentations as possible.

c. MJAS Sectional (P.M. session): 1) Presentation of all invited MJAS papers; 2) Poster session; 3) Certificates of achievement awarded to all presenters; 4) Announcement of overall top paper and alternates.

Instructions for Participation:

1. Science teachers are requested to contact potentially interested students immediately concerning this program.

2. For each participant, the following must be sent to the appropriate sectional vice-president to arrive no later than January 15, 1988: a) completed entry/membership form; b) a check made out to MAS for student membership ($5.00 fee includes a copy of the annual proceedings); c) a research paper authored by the student.

3. For additional information, contact Jim Cusker, MJAS Sectional Vice-President, Sentinel High School, Missoula, MT 59801 (728-2403 or 549-4449).

MONTANA JUNIOR ACADEMY OF SCIENCE

RESEARCH PAPER APPLICATION AND REQUEST FOR MJAS MEMBERSHIP

Student's Name _____

Teacher/Advisor's Name _____

High School _____ Year in School _____

School Address _____

Title of Paper _____

_____

_____

_____ _____

Student's Signature Teacher/Advisor's Signature

Attach this form to the research paper and submit by January 15 to the V.P. of the sectional checked below. Include a $5.00 check payable to MAS for 1988 membership.

_____ **BIOLOGICAL SCIENCES**
Tasneem Khaleel, Dept. Nat. Sci., Eastern Mt. Col., Billings, MT 59101

_____ **ENVIRONMENTAL SCIENCES AND ENGINEERING**
K. Ganesan, Environmental Eng., Montana Tech, Butte, MT 59701

_____ **MATHEMATICS, STATISTICS AND COMPUTER SCIENCE**
James Handley, Dept. of Math., Montana Tech, Butte, MT 59701

_____ **MICROBIOLOGY**
Jean Starkey, Dept. Micro., Mont. State Univ., Bozeman, MT 59717

_____ **PHARMACEUTICAL AND TOXICOLOGICAL SCIENCE**
Don Stierle, Dept. of Chemistry, Montana Tech, Butte, MT 59701

_____ **PHYSICAL SCIENCES**
William Sill, Dept. of Geophysics Eng., Montana Tech, Butte, MT 59701

_____ **SOCIAL SCIENCES**
George Waring, HSS, Montana Tech, Butte, MT 59701

(Do Not Write Below. For Official Use Only)

Selection Committee Evaluation
Value from 1 (low) to 10 (high)

1. Researchable question . . . . . _____
2. Literature review . . . . . _____
3. Research design . . . . . _____
4. Experimentation . . . . . _____
5. Data and/or results . . . . . _____
6. Conclusions . . . . . _____
7. Visuals, graphs, etc. . . . . _____
8. Clarity and completeness . . . . . _____
9. English usage . . . . . _____
10. Presentation, neatness . . . . . _____

Total

MONTANA ACADEMY OF SCIENCES SCHEDULES SPRING CONFERENCE

The 1988 Annual Meeting of The Montana Academy of Sciences will be held at Montana College of Mineral Science and Technology, March 25-26, 1988. The symposium, "Today's Precious Metals Issues in Montana," will be held March 25 with general presentation of papers on Saturday, March 26. The symposium will feature current technology for mining and metallurgy as well as public policies and economic impacts associated with this effort. Montana science and math teachers are encouraged to present papers and attend these informative meetings. For more information please contact: Linda L. Robinson, Vice-chairman for the Teaching of Science and Mathematics, 4408 Pine Cove Road, Billings, MT 59106.

MONTANA ACADEMY OF SCIENCES
Forty-Eighth Meeting
Montana Tech, Butte, MT
March 25-26, 1988

REQUEST FOR PAPERS

If you wish to present a paper at the 1988 meeting of the Montana Academy of Sciences in the Teaching of Science and Math section, please complete this form and send it to the address below.

1. Name _____

2. Affiliation _____

3. Sponsor name, if presenter is a student _____

4. Address _____

5. Title of paper _____

_____

6. Brief summary of topic to be covered _____

_____

_____

_____

7. What AV materials will you need? _____

_____

8. Please plan to publish this paper or an abstract in the PROCEEDINGS. Submit a copy of the manuscript in final form, conforming to the format of recent volumes of the PROCEEDINGS. Copies should be submitted to Linda Robinson.

9. Publication of articles in the PROCEEDINGS will be charged $10 per printed page. This charge may be modified depending on current prices. If author is a member of the Academy, two pages will be printed without charge.

Please return this form to:

Linda L. Robinson
4408 Pine Cove Road
Billings, MT 59106

NASA Broadcasts Demonstrate Classroom Aerospace Activities

Four satellite video conferences designed for classroom teachers have been prepared by NASA for the 1987-88 school year. Hour-long broadcasts on the Hubble Space Telescope and the Space Shuttle have been completed. They have been videotaped at the Office of Public Instruction and can be obtained, upon request, by sending a blank videotape to Ron Lukenbill, OPI, Helena, MT 59620. Other broadcasts will be: Feb. 16, 1988, *"Space Station"* 12:30-1:30 P.M. MST and March 15, 1988, *"Launch Vehicle Preparation"* 12:30-1:30 p.m. MST.

The forthcoming broadcasts are satellite programs requiring a receiving antenna only. The programs will utilize Westar IV, transponder 10D, Channel 19. Participants will be able to call in questions for the presenters on (405) 624-7101. Teachers who register beforehand will receive pre-program materials that include directions for tuning their antenna. Write or call Malcolm Phelps, (405) 624-7015, NASA Aerospace Education Project, Oklahoma State University, 300 North Cordell, Stillwater, OK 74078-0422. Attention: Teleconference Series.

Minutes of Annual M.S.T.A. General Membership Meeting

The general meeting of MSTA was called to order by President Kristy Bick on October 15, 1987, at 7:00 p.m. at the State Teachers Convention in Billings, Montana.

Officers were introduced. Doris Simonis was given an award for her contribution to the Newsletter.

Ron Kologi spoke about four programs available to teachers from NASA via satellite. These can be taped and shared. He asked that information about these programs be put in the next newsletter. The Office of Public Instruction is taping the programs and will make them available to teachers who would like them.

Kristy explained that the death of Bob Makela made it necessary for her to appoint Brenda Hansen as acting secretary. She asked that this be brought to a vote.

Doris Simonis made a motion that Brenda Hansen replace Bob Makela as secretary of the MSTA. Russ Hartford seconded. Motion carried.

Minutes were read and approved.

Doris Simonis spoke about the newsletter and stated that she needs material by November 1 for the winter issue. She asked that the membership share their ideas.

Gil Alexander handed out the Treasurer's Report and explained it.

Doris Simonis reported on the ongoing BEST project. She asked that the BEST members present reports on some of the interesting facets of last summer's institute.

New Business

Election of regional officers was held.

In Region I Gary Freebury nominated Russ Hartford for another term. Rich Micheletto seconded. Motion carried.

In Region II Gil Alexander nominated Steve Schumacher. Ken Price seconded. Motion carried.

In Region V Linda Robinson was nominated for another term by Kristy Bick. Brenda Hansen seconded. Motion carried.

The membership was reminded that the MAS Conference will be held in Butte on March 25 and 26.

Next year's convention will be held in Helena on October 13 and 14. Doug Shenkle asked for volunteers to help work on the convention.

Kristy commented on the success of the hospitality room at this year's convention and suggested we do it again at other conventions.

Linda discussed her involvement in MAS. She asked that papers be submitted on the teaching of Science and Math to be presented at the MAS conference. She asked for nominations for President-elect of MAS and for a new member-at-large.

Bob Briggs spoke on the Bob Makela Memorial Project and on Bob's dedication to the teaching of Science in Montana. He stressed the fact that Bob needs to be remembered in some way by our group. He suggested a scholarship, trust, and the establishment of a memorial for an object to be put in the State Capitol in memory of Bob's work on creating a state dinosaur.

Doris suggested that a Bob Makela Memorial Lecture sponsored by the MSTA be offered each year at the convention.

A committee was established with Rich Micheletto as chairman to look into the above suggestions. Gil Alexander made a motion that memorial donations be sent to Rich. Russ seconded. Motion carried.

Jim Cusker talked about the establishment of a Junior Academy of Science to collaborate with the Montana Academy of Sciences. He asked the MSTA to help fund a student's trip to National Junior Academy of Science. He requested $250. He put his request in the form of a motion. Russ seconded. Motion carried.

Ken Price pointed out to the membership that the Edison Foundation Program will be in Bozeman the same week as the MAS conference.

Ken Price suggested that Kristy contact MEA about our share of convention funds.

Doug Shenkle made a motion to increase the dues from $8 to $10 effective June 1, 1988. Ken Price seconded. Motion carried.

Doug Shenkle made a motion for prior approval to have up to $300 available from MSTA for unanticipated expenses which should occur for the MEA/MSTA Convention in 1988. Ken Price seconded. Motion carried.

A suggestion was made to carry registration forms back to home towns.

Bob Briggs asked for suggestions for next year's general meeting—time, place, etc.

A late afternoon meeting was suggested with a banquet following.

The meeting was adjourned.

Brenda Hansen
Secretary

Treasurer's Report MSTA October 14, 1987

Dear MSTA Members,

The last report of the treasurer indicated a balance of $3,992.53 as of October 15, 1986. Since that time the MSTA has acquired $4,943.15 in revenue divided into $4,712.00 from dues and convention payment and $213.15 earned as interest. We have had expenses totaling $5,507.81. In addition, the MSTA has acquired $152,000 through the Montana BEST program. Most of these BEST monies are encumbered, but MSTA should still note a substantial increase in overall revenue necessary to operate the BEST program.

A monthly summary of activity since the last report is included.

Month	Deposits	Interest	Withdrawals	Balance
Oct. '86	1244.00	16.23	531.25	4492.76
Nov. '86	3081.00	27.49	1091.48	6509.77
Dec. '86	30.00	28.01	106.50	6461.28
Jan. '87	00.00	25.69	300.00	6186.97
Feb. '87	106.00	21.51	1134.20	5180.28
Mar. '87	46.00	17.82	230.77	5013.33
Apr. '87	00.00	17.96	00.00	5031.29
May '87	47.00	20.05	00.00	5098.34
Jun. '87	00.00	17.52	1303.50	3812.36
Jul. '87	00.00	12.94	500.00	3325.30
Aug. '87	00.00	13.56	00.00	3338.86
Sep. '87	00.00	12.37	00.00	3351.23
Oct. '87	158.00	?	310.11	3199.12

This represents all activity up until the time of the MSTA meeting this year.

Respectfully submitted,

Gil R. Alexander

Gil R. Alexander
Treasurer, MSTA

Better Elementary Science Teaching (BEST)

Summer 1988, University of Montana

The Montana Science Teachers Association, the Office of Public Instruction and the University System announce Montana's BEST Project. The project is designed to develop a comprehensive and ongoing statewide science inservice program to develop elementary science advocates. To achieve our goals, a three-part program has been developed and funded by a grant from the National Science Foundation. The three parts are:

1. **Regional Summer Institutes:** The University of Montana will host the second institute which will be open to elementary school teachers from western Montana. Teachers from other Montana areas will be considered on an individual basis. The institute will start on July 17, 1988 and run for four weeks. (Montana State University will serve central Montana in 1989.) The course work of the summer institutes will consist of an intensive effort to update as well as upgrade science content material, develop the participants' management techniques, provide for a statewide computer bulletin board network, and encourage science sharing.

2. **Inservice Workshops:** Upon completion of the institute, the new advocates may provide inservice opportunities in their schools. We intend that two-thirds of the elementary teachers in Montana will be affected by the programs delivered by the advocates.

3. **Long-term Follow-up:** Comprised of three parts: a) electronic telecommunication network for the advocates and their schools; b) university faculty field support for the advocates; c) follow-up conferences for the advocates.

Participant Support

Participants will receive $160 per week, a private dormitory room, all meals, travel expenses, and an assortment of extracurricular activities (free or at a reduced cost) from which to choose. An account in each participant's name will be set up at the UM Bookstore from which materials and supplies may be purchased and charged to the institute.

One of the most important outcomes of the program is to foster a collegial spirit among the advocates. Hence, the program will provide the majority of the needs of the advocates in order to free them to develop lasting working relationships with their colleagues. The result will be a network of elementary science advocates sharing ideas and improving science education for the children of Montana.

Eligibility and Critical Dates

Each applicant's selection will be based upon the following criteria:

1. The candidate's overall potential to become a science advocate;
2. Teaching experience;
3. Interest in science;
4. Geographic location (we want to include participants from the entire region, not just the larger communities);
5. Grade level (we want to ensure that all grades K-6 have participants);
6. Willingness on the part of the school administrators and local school boards to commit support to the science advocates after completion of the summer institute;
7. Willingness of the participant to live in the dorm on campus during institute sessions;
8. Appropriate microcomputer provided by school district.

All teacher applications and recommendation forms must be postmarked no later than March 1, 1988 for this year's institute. Participants will be notified by April 1, 1988.

For further information and application packets write: BEST Project, School of Education, University of Montana, Missoula, MT 59812 or phone 243-2378 or 243-4912.

Who's Frank Whittle?

Reprinted from the April 22, 1987 issue of the Washington Post.

Ask anyone over the age of 14, let's say, who invented the electric light bulb and they will most likely, and correctly, answer, "Thomas Edison."

Put the same query to them about the creator of the telephone and the immediate and unhesitating response would be, "Alexander Graham Bell." The respondent might even volunteer the first telephonic message, "Come here, Mr. Watson, I need you."

However, if the same person, even someone several years older than our 14-year-old, were asked to name the inventor of the jet aircraft engine the reply would probably be, "Huh?"

The jet engine has probably not exerted the same universal influence as the electric light bulb and telephone, nevertheless, it has made an enormous impact, even on those who have never once travelled by airplane.

Oh, who invented the jet engine?

It was Frank Whittle, later Sir Frank Whittle. He did it 50 years ago in Great Britain.

We are indebted to *Aviation Week and Space Technology* for this intelligence. That magazine also provided, with quotes from Sir Frank himself, helpful insight into that auspicious event.

This is how *Aviation Week* describes the birth of the jet age:

The first full test run was made on April 12, 1937, with the engine mounted on a test stand and its exhaust nozzle aimed out a factory window. The engineering crew gathered to watch, and in Whittle's own words, the first test run produced exciting results.

"The experience was frightening," he wrote. The engine was accelerated to 2,000 rpm by an electric starter motor and Whittle opened the fuel valve to the main burner. "Immediately, with a rising scream, the engine began to accelerate out of control." Shutting off the fuel valve had no effect and Whittle stood "paralyzed with fright" while the rest of his team bolted for safety.

It was an inauspicious beginning and only a preview of what was to come. On the second run the next day, the engine again accelerated uncontrollably and finally caught fire. "Altogether a petrifying situation—except for those who once more disappeared with record-breaking speed" was how Whittle described it.

From that day the world began to shrink at a rather dizzying pace.

In the past half century, for example, a week-long trip by ocean liner from New York to England has shrunk to a scant six or seven hours by Boeing 747 or Douglas DC-10, even faster by the supersonic Concorde.

The jet engine, perhaps regrettably, has changed warfare. The piston-engined planes of World War II have been replaced by supersonic fighters capable of carrying bomb loads greater than a B-17 and travelling at twice the speed of sound, or faster.

The jet engine has wrought enormous changes in the contemporary world. It has enabled millions of ordinary persons, for example, to spend their two-week vacations in distant lands, something that a half century or so ago was a pleasure reserved for the wealthy and unencumbered.

It has facilitated the course of business. Documents that previously took days to go across the country are in the hands of their addressees within hours.

In short, people and material now move from Point A to Point B with an ease, speed and safety that have been accepted as commonplace, even ordinary. People are now routinely pushed across the sky by planes equipped with four 54,000-pound thrust, or larger, "monsters," unaware that it all started 50 years ago with a primitive, 1,200-pound thrust engine, produced by a man whose name is anything but a household word—Sir Frank Whittle.

Statewide Science Education Changes

This article will be so brief that absolute correctness will suffer but essentially many changes in Montana education may result indirectly from the now famous lawsuit between the have and have-not schools. From that suit it became apparent that little agreement existed as to just what constituted a "basic" and thus state guaranteed education. The present accreditation standards were not considered sufficient for the task and the Montana legislature asked the Board of Public Education, in cooperation with the Office of Public Instruction, to design a new set of standards that would reflect Montana's educational needs for the year 200 and beyond.

The board appointed Claudette Morton to direct the effort that is now called "Project Excellence." A direction setting meeting was held in Helena, September 18, 1987, that attracted over 400 educators and citizens. Their purpose was to look back at the last 100 years of Montana education and then to project our needs for the next 100 years. This meeting focused on four main categories: physical and mental well being, thinking, communications and citizenship. The object was to consider what things in each category would remain the same and which would change. Priorities were then established and consensus reached on how these objectives might be achieved. A summary document was produced and is available from the Board of Public Education.

A number of action groups were selected by the Board of Public Education to address the need for learner outcomes and implementation strategies for the various disciplines. The science action group consists of chairman, Jim Foster, Superintendent of the Chester School District; Jim Cusker, biology teacher from Missoula; Bob Moodry, mining engineer from Butte; Leo Perkins, elementary teacher from Deer Lodge; Marilyn Taylor, past Montana PTA president from Forsyth; Janet Thomson, district curriculum coordinator from Great Falls; Gerry Wheeler, physics professor from Montana State University; and Tom Zwick, district board person from Hardin (also a geology professor from Eastern Montana College). Roger Swearengen, OPI Vocational Education, is serving as committee facilitator and Bob Briggs is assigned as the science resource person.

At the first meeting of the Science Action Group, the Montana Science Advisory Committee (MSAC) document was used almost exclusively by this group and resulted in a very cooperative meeting that polished, adapted and finally adopted the MSAC set of outcomes. The Science Action Group worked very hard and was an excellent group to work with. Their document was selected by the Board of Public Education as an excellent example for the rest of the disciplines to follow.

The Montana Science Advisory Council has since had additional meetings to make extensive changes in the teacher preparation and certification standards. Extensive cooperation between NSTA, MSTA, MSAC, NCATE, MCATE, and OPI are almost certain to result in some very positive improvements in this important area.

In the meantime, the Science Action Group is working on ways to implement the learner outcomes that have been developed. We will keep you informed as they proceed with their task.

For those of you that are concerned about local control, please rest assured that it has been preserved. The science recommendations have been made with local control as their first consideration and improved science education second. It would be dishonest, however, to tell you that politics, at all levels, has not played a part in these activities. It has and will continue to do so.

Someday, after the project is completed, the public hearings are held and changes are approved, the Montana Science Advisory Council will try to find a way to publish the advisory documents for those interested. It is hoped that MSTA or MSAC will eventually produce an advisory curriculum guide for Montana teachers of science.

Montana Science Fair in Missoula

The 33rd Montana Science Fair will be held April 8-9, 1988, at the University of Montana Field House in Missoula, Montana. Science teachers and students in grades 7 through 12 are encouraged to start making plans to attend this year's fair.

As in previous years, the two Grand Award winners in Division I will receive an all-expense paid trip to the International Science and Engineering Fair. This year's fair will be held May 8-14, 1988, in Knoxville, Tennessee.

For further information on the Montana Science Fair, contact Professor R.H. Jeppesen, Dept. of Physics & Astronomy, University of Montana, Missoula, MT 59812. High school students contemplating vertebrate experiments should contact Professor Jeppesen as soon as possible in order to get a copy of the rules and regulations concerning such experiments.

**"Thousands of Science Projects," a 104-page book, lists topics used by Westinghouse Talent Search International Science and Engineering Fair students. It is a good source of ideas. Write: Thousands, Science Service, 1719 N St., NW, Washington, DC 20036. Price is $3.00.

Region 1 Workshop To Be Held

The MSTA is sponsoring a workshop for junior high and high school science teachers from all of Region 1. The workshop will be held in Kalispell on Monday, April 11, 1988. All participants will be asked to bring their text, lab manual, and present one item of general interest. The general interest item may be a lab, a demonstration that works well for them, or anything that helps them or their students in their classroom. We urge everyone in Region 1 to participate and make this pilot program a success.

Coming Events Calendar 1988

Feb. 16—"Space Station" video conference, 12:30-1:30 MST

Feb. 24-27—Intermountain Science Symposium, Salt Lake City

Mar. 15—"Launch Vehicle Preparation" video conference, 12:30-1:30 MST

Mar. 25-26—Montana Academy of Science meets in Butte

Mar. 25-26—Thomas Alva Edison Science Institute, Bozeman

Apr. 7-9—National Science Teachers Assoc. Annual Meeting, St. Louis, MO

Apr. 8-9—Science Fair in Missoula

Apr. 11—Region I Science Teachers Workshop in Kalispell

June 18-19—Special Workshop on Montana's Endangered Mammals, Missoula

July 17-Aug. 19—BEST Summer Institute, UM, Missoula

MSTA Newsletter is a quarterly publication providing news and ideas for teachers of science. Share your plans, projects and ideas. Send items for the next issue to Doris Simonis, Editor, School of Education, University of Montana, Missoula, MT 59812 by January 6, 1988.

Grant Monies Available

Have you got a senior who might be interested in $500? Write Bob Briggs, Office of Public Instruction, State Capitol, Helena, MT 59620, for information about a Montana Academy of Science Scholarship!

Students Can Compete for Science Scholarships

High school seniors can compete for national scholarships totaling $140,000 in the annual Montana Science Talent Search, according to Dr. Lindsey Hess, associate professor of mathematical sciences at Montana Tech and state director for the competition.

The Montana talent search, held in conjunction with the 47th annual Westinghouse Science Scholarships and Awards program, "is designed to discover and develop scientific and engineering ability among high school seniors," Hess said, adding that five former national winners have gone on to win the Nobel Prize.

Students must prepare independent research projects and complete a personal data sheet. The top 40 young men and women in the country will earn a five-day, expenses-paid trip to Washington, DC where they will compete for the national scholarships.

In 45 national science searches, Montana has had 11 national winners and 98 in the honors group, Hess said.

Montana winners will receive awards and plaques and will also be considered for academic scholarships to Montana Tech.

Nationally, the top scholarship is $20,000, Hess said. Also awarded will be two $15,000, three $10,000, four $7,500 and 30 $1,000 scholarships.

For information on these scholarships write: Science Service Inc., 1719 N Street, N.W., Washington, D.C. 20036.

Resources for Teachers

Stretching Your Mind teaching kit for grades 4-7 includes guide, wall chart, and duplicating masters that emphasize scientific method. **Free** if you send a request on school stationery to Educational Bureau, Firestone Tire and Rubber Company, 1200 Firestone Parkway, Akron, OH 44317.

Science Projects—A Modular Approach by Mark Farmer, 1987, is a step-by-step manual for development of successful science projects. Checklists, worksheets, resource guides, humor, and specific recommendations to encourage students and to help them organize their work make this publication invaluable to secondary science teachers and their students. Copies are available for $5.50 from: Applied Educational Technology, P.O. Box 193, Tigerville, SC 29688.

We All Need Trees is a four-color poster to show how important trees are to people and to wildlife. It complements *Project Learning Tree* and the Naturescope series. Cost is $1 from American Forest Institute, 1619 Massachusetts Avenue, N.W., Washington, DC 20036.

Three free newsletters that give ideas for teachers can be obtained by request on school stationery to:

SSTS Reporter, Science Through Science, Technology, and Society, Pennsylvania State University, 128 Willard Building, University Park, PA 16802.

Arbor Day Newsletter, The National Arbor Day Foundation, 100 Arbor Avenue, Nebraska City, NE 68410.

Natural Resources Register, Michigan DNR, Box 30028, Lansing, MI 48909.

How Big Is Small?

We often find reference to "parts per billion" or "parts per trillion" in our reading or conversations about trace impurities in chemicals.

What is a part per billion? How big is a part per trillion? And what about a part per quadrillion? Can we get a fix on these infinitesimally small quantities?

Well, if you're a 26-year-old male, for example, your heart beats about 72 times a minute; a part per billion is equal to one heartbeat out of all your heartbeats since birth (plus half your prenatal experience!).

Let's start with a part per million, our largest scale. . .that's the equivalent of one automobile in bumper to bumper traffic stretching from Cleveland to San Francisco. . .or one drop of gasoline in a tankful of gas for a full-sized car. . .or one facial tissue in a stack of facial tissues higher than the Empire State Building. It's also one pancake in a stack of pancakes 4 miles high!

Still hungry? How about one 4-inch hamburger in a chain of hamburgers circling the earth 2.5 times at the equator? That's equal to one part per billion. . .pass the mustard!

Some Other Comparisons

Part Per Billion

- One silver dollar in a roll of silver dollars stretching from Detroit to Salt Lake City.
- One kernal (sic) of corn in enough corn to fill a 45-foot silo, 16 feet in diameter.
- One sheet in a roll of toilet paper stretching from New York to London.
- One second of time in 32 years.

Parts Per Trillion

- One square foot of floor tile on a kitchen floor the size of Indiana.
- One drop of detergent in enough dishwater to fill a string of railroad tank cars over 10 miles long.
- One second of time in the past 32,000 years.
- One mile on a 2 month journey at the speed of light (light travels at 186,000 miles per second).

How about something *really* small?

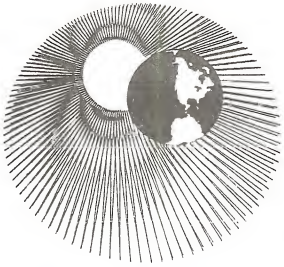
Parts Per Quadrillion

- One postage stamp on a "letter" the size of California and Oregon combined.
- The palm of one's hand compared to the total land area of the United States.
- One human hair out of all the hair on the heads of all the people in the world.
- One mile on a journey of 170 light years. . . (1,000,000,000,000,000).

From: "How Big is Small?"—The Dow Chemical Company.

EDUCATORS' NETWORK

a project of the
Climate Protection Institute
159 Thomas Paine Avenue
New Rochelle, NY 10804 (914) 235-0223

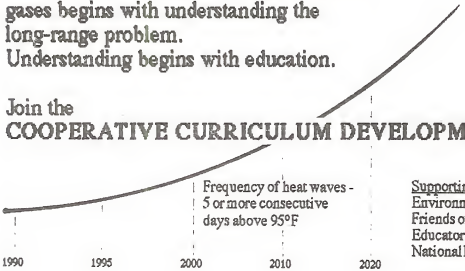


What can educators do about the threat of global climate change due to the GREENHOUSE EFFECT?

A lot!

Reduction of the emission of greenhouse gases begins with understanding the long-range problem.
Understanding begins with education.

Join the
COOPERATIVE CURRICULUM DEVELOPMENT PROJECT



Supporting groups
Environmental Education Committee - Sierra Club
Friends of the Earth
Educators for Social Responsibility
National Earth Science Teachers Association

To: CLIMATE PROTECTION INSTITUTE, 159 Thomas Paine Avenue, New Rochelle, NY 10804 (914) 235-0223
Re: Educators' Network Project

Put my name on the list of educators concerned about the threat of global warming.

I want to receive lesson plans that I can use in my classroom that will address the topic of GLOBAL CLIMATE CHANGE - its science and its environmental and social consequences.

I am particularly interested in material for grade(s) _____ I have some curriculum ideas to suggest. ☐

Name _____ School _____

Address _____ Telephone _____

City _____ State _____ (Province) Zip _____ (Postal code)

Inclusion of Nonscience Tenets in Science Instruction

People have always been curious about the universe and their place in it. They have questioned, explored, probed and conjectured. In an effort to organize their understanding, people have developed various systems that help them explain their origin, e.g., philosophy, religion, folklore, the arts, and science.

Science is the system of exploring the universe through data collected and controlled by experimentation. As data are collected, theories are advanced to explain and account for what has been observed. Before a theory can be included in the system of science, it must meet all of the following criteria: (1) its ability to explain what has been observed, (2) its ability to predict what has not yet been observed, and (3) its ability to be tested by further experimentation and to be modified as required by the acquisition of new data.

NSTA recognizes that only certain tenets are appropriate to science education. Specific guidelines must be followed to determine what does belong in science education. NSTA endorses the following tenets:

I. Respect the right of any person to learn the history and content of all systems and to decide what can contribute to an individual understanding of our universe and our place in it.

II. In explaining natural phenomena, science instruction should only include those theories that can properly be called science.

III. To ascertain whether a particular theory is properly in the realm of science education, apply the criteria stated above, i.e., (1) the theory can explain what has been observed, (2) the theory can predict that which has not yet been observed, (3) the theory can be tested by further experimentation and be modified as new data are required.

IV. Oppose any action that attempts to legislate, mandate, or coerce the inclusion in the body of science education, including textbooks, any tenets which cannot meet the above-stated criteria.

Science Limericks

Nancy Craig
Lamoille Union High School, Hyde Park, Vermont

The eighth-grade physical science students at Lamoille Union High school were given the assignment to choose two topics they recently learned and work them into two limericks. In order to complete the assignment, they had to follow the limerick form and express ideas that were scientifically accurate.

Before the students put pen to paper, we discussed the five-line limerick form and read several limericks aloud. The students also learned about the rhyming dictionary in the library that could help them with their rhyme schemes.

Delighted with the assignment, most of the students composed their limericks enthusiastically. The language arts teachers were also pleased because the limerick assignment demonstrated the relationship among different disciplines. In fact, the assignment was so successful that the class decided to publish the results. We typed up the best of the limericks on a ditto form and produced a booklet for each student.

The students were excited about the opportunity to be creative and humorous in science class, and they were proud of the results of their efforts. The following are examples of work from our "published authors."

The Short Little Atom

There once was an atom from Peru,
Who wanted to play ball for Purdue.
But it was true
He was only five angstroms two,
And there was nothing the poor atom could do.

Lance Lamb

Bernoulli

There once was a man called Bernoulli
Who everyone thought was unruly.
But one summer's night
while flying his kite
He proved his principle newly.

Damon Kinzie

Displacement

There is now a matter of displacement
That has nothing to do with my basement.
It was thought up by Archimedes,
Who ran naked in the streeties,
And forgot all about his clothes misplacement.

Cathy Fletcher

The Polluted Solution

I drank the liquid solution
Even through all the pollution
The temperature was hot
The taste was not,
And it caused a stomach revolution.

Brian Jones

Counting Calories

There was a young woman named Valerie
Who counted every calorie
She said with a sigh
"Oh me! Oh my!"
"I wish this was my salary!"

Cara Allen

Levers

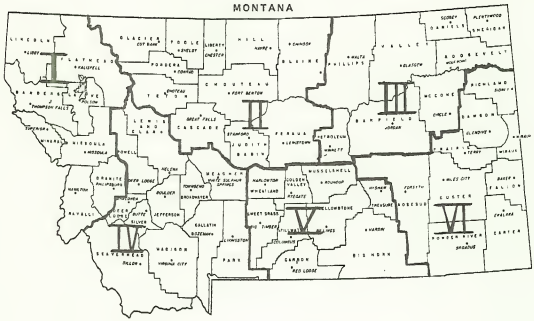
People who sometimes use levers
Are really sometimes quite clever.
An example is pliers,
Which are used to twist wires,
Examples could go on forever.

Karen Chase

Density

There was once a grumpy old stork
Who when asked the density of cork,
Replied, "It's .2
But whatever you do
Leave or get hit by my fork."

Katy Beautal



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Membership Category:

1 year $8.00_____

2 years $15.00_____

3 years $22.00_____

1 yr/Student $3.00_____
Retired

Return this statement with your check payable to MSTA to the above address.

MEMBERSHIP APPLICATION (Please Print)

Name _____
Last First Middle

Address _____

_____
County City State Zip Code

Phone ( )_____ Date _____

Name of School/Affiliation _____

MSTA Region (see map on cover)_____

Grade Level: Subject:

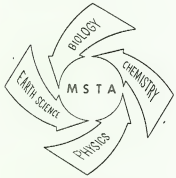
____K-6	____Integrated Science		
____6-9	____Life Sci	____Biol	
____9-12	____Phy Sci	____Chem	
____Col/Univ	____Earth Sci	____Phys	
____Sup/Adv	____Other	____Mth	

Membership includes one year subscription (4 issues) to *The Montana Science Teacher*

MSTA will help the individual participate in determining the destiny of science education in Montana. The organization serves as a vehicle for educators from all professions to exert positive influences on young people. Many important decisions concerning the scope and direction of science education will be strongly influenced by our organization.

The MSTA goals are to increase public awareness, interest and support of science education in Montana.

Montana Science Teachers Association



Dedicated to quality science education

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Ed Argenbright, Superintendent
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Helena, MT 59620